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# Effects of extended work shifts on employee fatigue, health, satisfaction, work/family balance, and patient safety

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**Abstract.** 12-hour shifts are quickly spreading in Europe. From our multivariate analysis concerning 25,924 European nurses, including twenty explanatory variables simultaneously, we found that work schedule itself is not a major determinant factor. Nurses aim to choose or accept night shifts or 12-hour shift in order to reduce their work/home conflicts, however, at the expense of the patient's safety, as well as their own health and safety. Therefore, it is important to develop measures, such as extended child care, association of nurses to the elaboration of their rota, 9- or 10-hour shifts in the afternoon, allowing naps during night shifts, and reduction of changing shifts with short notice. Work schedules must be organized in order to allow time for shift handover, social support and team building.

**Keywords:** Nurses, 12-hour shifts, Work/family balance, Burnout, Gender

## 1. Introduction

Work schedules should primarily be beneficial for employee fatigue, health, satisfaction, work/family balance, and patient safety. However, although previous research has found positive effects of 12-hour shifts on employee satisfaction with working hours and free time, the impact of 12-hour shifts on employee fatigue, health and patient safety has mostly been non-significant or negative:

Recent evidence supports the negative impact of long work hours and its potential risks to nurses' health and to patient safety [3-4, 14-16]. However, 12-hour shifts are quickly spreading in Europe. In order to be able to formulate sound work schedule practices, a careful examination of shift work practices together with its internal system consequences, nurses' satisfaction, health and environmental factors is needed. The objective of our study was to perform a secondary analysis of a large

European data base, collected in 2003 [5-7], in order to determine the effect of work schedule among paramedical staff on these three parameters (work/family balance, health and safety), after adjustment for various risk factors.

## 2. Methods

### 2.1. Procedure and Sample

The NEXT study team has recruited, in ten European countries, health care institutions for participation in a survey aimed at a reflection of national distribution of nurses working in different types of institutions (hospitals, nursing homes, and home care), and across different geographical regions. Both the employer and the employee representative had to agree to participate. The completed questionnaires were returned to the

national research institution by post, using a pre-paid envelope. In order to enhance ability to generalize, respondents were sampled across three different kinds of health care institutions, according to the specific repartition in each country: hospitals ( $N = 147$ ), nursing homes ( $N = 185$ ), and home care institutions ( $N = 76$ ). The survey was sent to 77,681 nurses, of whom 39,898 (51.7%) responded. We obtained sufficient data about the work schedule of 25,924 nurses.

## 2.2. Analyses

Our primary interest was satisfaction with work-schedules for well-being and for family life (single questions), and extent of Work-family conflict (W/FC) (five-item scale) [13]. As indicators for personal risk factors the following variables were included: Age; Seniority; Gender; Occupational level; Personal-family situation; Enough child care when at work; Satisfaction with pay (3-item scale).

As indicators for health problems we used several indicators, Burnout [10], Work-ability index [8], and single questions: How often do you feel tired? In periods when you are working, do you get sufficient sleep? Sleep quality on working days? Number of days of sick-leave declared.

As indicators for working conditions, the following variables were included: Being satisfied with staff handovers when shifts change; Being confronted with not knowing what a patient or a patient's family ought to be told about the patient's medical condition and its treatment; Have many interruptions and disturbances in the job; Being worried about making mistakes; Quantitative demand score indicating work intensity, measured using a 5-item scale based on the Copenhagen Psychosocial Questionnaire [11] and supplemented by a nursing specific item.; Physical load score, that we developed with 3 questions about 'lifting patients in bed without aid', 'maintaining an uncomfortable posture', and 'working in standing posture' [5], Quality of teamwork score that we developed [5-6]; Over-commitment score, measured with the short form of the Intrinsic Effort Scale [16] (5 items focus on the "inability to withdraw from work" and one item focuses on "disproportionate irritability."). More detailed information on the psychometric properties of the different variables used can be found in previous publications [5-7].

The Type of work schedule was calculated with the description of starting and ending time for each schedule. All types of part-time work were grouped

in one category; Day length 7h-8h30 was grouped in the category '8-hour shift'; Day 8h31-11h30 was grouped in the category '10-hour shift'; Day > 11h31 was grouped in the category '12-hour shift', similar categories were calculated for Night work; Alternating shifts were categorised in two groups, according to the number of nights worked per month <6 nights (mostly alternating morning and afternoon shift of 8 to 10 hours) or  $\geq 6$  nights (mostly alternating 12-hour shift day and night). Also, several single questions were used: How many weekends (Saturday and/or Sunday) per month do you have to work? How often in one month do you have to get up before 5 o'clock in the morning to go to work? How often do you have to take over shifts with short notice? (1 to 3 days in advance)? How often in one month do you have a split shift?

For the major variables, bivariate tables were derived, using Pearson's Chi square test. Subsequently, for each dependent variable, a multivariate analysis using SPSS 12.0 software was performed (binary logistic regressions with 95% confidence intervals). Overall, fewer than 10 % of the different questions yielded missing data. For some variables that comprised several items, the missing data were the cause of the differences in sample sizes across the variables. We also re-conducted the multivariate analysis stratified by gender [12] but no clear difference in results emerged. If not otherwise specified, all significant relationships reached a .001 significance level.

## 3. Results

### 3.1. Work schedules and Work/family balance

Nurses working part time but also nurses working 12-hour shift during the day and those working at night with 8 hour shift are a majority with low W/FC (Table1). The above groups, plus nurses working 12-hour shift during the night report being satisfied with working time for their private life. On the other hand, nurses working alternating shifts and 10-hour shift at night report more difficulties with their private and family life. Extended work shifts are a solution for difficulties with child care, as they reduce the number of working days, which is efficient for nurses who have not enough childcare when at work. More female than male nurses work extended work shifts.

We must also note that 33.9% of male nurses work overtime, compare to 26.2% of the female nurses.

Interestingly, only 23.3% of male nurses do the household chores themselves, compared to 72.7% of the female nurses. Furthermore, only 2.3% of male nurses live alone with one or more children, compared to 6.8% of the female nurses (and 9.9% of those working Night 12-h shift, 8.5% Day 8-hour shift and 8.4% Day10-hour shift). Male nurses with no children more frequently accept alternating shifts while female nurses with a child prefer 12-hour shifts during the day or night. Clearly nurses older than 45

try to leave alternating shifts. However, other aspects of work schedules influence family balance and they are reported less frequently by the nurses working extended work shifts. Indeed, nurses working 12-hour shift during the day and the night are less frequently obliged to take over shifts at short notice, or to get up before 5 AM to go to work. Nurses working 12-hour night shifts report week-end work and split shifts less frequently.

Table 1  
Work schedules of European nurses and work/family balance

		Part time	Day 8 h	Day 10 h	Day 12 h	Night 8 h	Night 10 h	Night 12 h	Altern. <6N/m	Altern. ≥6 N/m	Total
Work/ family conflicts	Low	<b>55.4%</b>	43.9%	39.9%	<b>50.5%</b>	<b>51.2%</b>	35.3%	40.6%	39.7%	43.0%	44.1%
	Medium	31.6%	32.2%	33.2%	32.4%	33.1%	35.5%	35.4%	34.3%	33.5%	33.1%
	High	13.0%	23.9%	26.9%	17.1%	15.7%	29.2%	24.0%	26.0%	23.5%	22.7%
	N	3847	7399	687	933	686	3478	483	3121	2686	23320
Satisfied w. working time / private life	Yes	<b>74.6%</b>	64.1%	63.5%	<b>66.4%</b>	<b>64.4%</b>	59.6%	<b>69.2%</b>	50.3%	56.6%	62.6%
	No	25.4%	35.9%	36.5%	33.6%	35.6%	<b>40.4%</b>	30.8%	<b>49.7%</b>	<b>43.4%</b>	37.4%
	N	3909	7489	1185	1182	679	3414	676	3522	2847	24903
Enough child care when at work	Yes or no answer	92.4%	88.8%	91.9%	88.1%	94.2%	87.6%	87.3%	89.3%	86.2%	89.2%
	No	7.6%	11.2%	8.1%	<b>11.9%</b>	5.8%	<b>12.4%</b>	<b>12.7%</b>	10.7%	<b>13.8%</b>	10.8%
	N	4040	7026	1145	1214	695	3528	675	3017	2857	24197
Age	<30 years old	21.3%	16.7%	17.1%	20.1%	28.9%	17.5%	15.9%	25.8%	23.8%	20.1%
	30-45 years old	55.9%	52.4%	57.2%	64.7%	55.4%	60.3%	53.4%	54.5%	64.1%	56.6%
	>45 years old	22.8%	30.9%	25.7%	<b>15.3%</b>	<b>15.6%</b>	22.2%	30.7%	<b>19.7%</b>	<b>12.1%</b>	23.3%
	N	4035	7798	1213	1211	691	3574	698	3560	2902	25682
Gender	female	<b>91.2%</b>	89.0%	89.4%	<b>94.9%</b>	86.7%	78.1%	<b>90.7%</b>	89.8%	91.5%	88.5%
	male	8.8%	11.0%	10.6%	5.1%	13.3%	<b>21.9%</b>	9.3%	10.2%	8.5%	11.5%
	N	4044	7843	1222	1217	692	3599	702	3582	2917	25818
Family situation Female nurses	With adult	26.3%	27.0%	30.5%	21.9%	32.0%	27.1%	25.5%	31.0%	24.1%	27.1%
	Alone	8.9%	13.9%	12.3%	9.2%	13.7%	14.6%	11.2%	15.0%	10.7%	12.6%
	Alone with child	4.6%	<b>8.5%</b>	<b>8.4%</b>	<b>7.7%</b>	2.7%	6.2%	<b>9.9%</b>	5.8%	6.3%	<b>6.8%</b>
	With adult + child	60.1%	50.7%	48.7%	<b>61.2%</b>	51.5%	52.0%	<b>53.4%</b>	48.2%	58.9%	53.5%
Family situation Male nurses	With adult	27.5%	27.3%	29.9%	41.7%	30.0%	26.8%	24.2%	<b>31.2%</b>	<b>31.0%</b>	28.4%
	Alone	11.0%	16.3%	17.3%	13.3%	15.6%	13.9%	17.7%	<b>21.9%</b>	<b>18.2%</b>	15.9%
	Alone with child	1.7%	2.7%	3.1%	1.7%	1.1%	1.8%	<b>9.7%</b>	1.1%	3.3%	<b>2.3%</b>
	With adult + child	59.8%	53.7%	49.6%	43.3%	53.3%	57.5%	48.4%	45.8%	47.5%	53.4%
How often do you have to take over shifts at short notice? (1 to 3 days in advance)	2// month or less	90.4%	90.1%	90.1%	94.8%	92.6%	88.2%	93.0%	91.5%	92.6%	90.8%
	> 2 / month	9.6%	9.9%	9.9%	<b>5.2%</b>	7.4%	11.8%	<b>7.0%</b>	8.5%	7.4%	9.2%
	N	3503	6947	1135	1167	660	3281	645	3529	2852	23719
How often in one month do you have to get up before 5 o'clock in the morning to go to work?	No	91.3%	73.9%	74.5%	59.5%	83.7%	79.8%	83.2%	67.1%	51.9%	74.1%
	1-5/month	5.9%	17.5%	17.9%	34.1%	15.0%	16.0%	10.9%	23.5%	41.0%	19.4%
	6+/month	2.7%	8.6%	7.7%	<b>6.5%</b>	<b>1.3%</b>	<b>4.2%</b>	<b>5.9%</b>	9.5%	7.0%	6.5%
	N	3877	7412	689	945	687	3505	488	3151	2728	23482
On how many weekends (Saturday and/or Sunday) per month do you have to work?	2// month or less	86.4%	77.4%	76.3%	61.3%	77.3%	56.6%	78.7%	66.3%	49.3%	70.3%
	> 2 / month	<b>13.6%</b>	22.6%	23.7%	38.7%	22.7%	43.4%	<b>21.3%</b>	33.7%	50.7%	29.7%
	N	3899	7475	1192	1206	683	3498	687	3568	2902	25110
Do you have split shift?	No	59.9%	76.1%	72.2%	68.1%	79.7%	77.9%	82.5%	81.6%	69.8%	73.6%
	Yes	40.1%	23.9%	27.8%	31.9%	20.3%	22.1%	<b>17.5%</b>	<b>18.4%</b>	30.2%	26.4%
	N	3334	6321	612	907	650	3078	429	3097	2654	21082

### 3.2. Work schedules, work content and Health

Work organisation differs highly according to work schedules, and this influences W/FC (Table 2). Nurses working 10- or 12-hour shift at night are more often dissatisfied with staff handovers when shifts

change. Nurses working 12-hour day and night shifts and those working alternating shifts including many nights often do not know what a patient or family ought to be told, they worry more about making mistakes and more report low quality of teamwork. More than 30 % of day nurses show a high over-

commitment score (at home, switch off not easy...). Nurses working 12-hour shifts during the day and those working alternating shifts report more interruptions and disturbances in the job, high quantitative demand and high physical load.

Even if nurses working 10- or 12-hour shifts state more often that they are satisfied with family life, their health is often worse, compared to nurses working 8-hour shift (Table 2 part 2).

Table 2  
Work schedules of European nurses, work/content and health

		Part time	Day 8 h	Day 10 h	Day 12 h	Night 8 h	Night 10 h	Night 12 h	Altern. <6N/m	Altern. ≥6N/m	Total
Are you satisfied with staff handovers when shifts change?	Yes	71.3%	55.5%	69.3%	68.5%	64.8%	51.6%	54.6%	60.7%	66.4%	60.9%
	No	28.7%	<b>44.5%</b>	30.7%	31.5%	35.2%	<b>48.4%</b>	<b>45.4%</b>	39.3%	33.6%	39.1%
	N	3548	6712	1125	1177	674	3346	643	3525	2878	23628
Not knowing what a patient or family ought to be told ab. patient's condition and treatment	Never or sometimes	77.7%	69.3%	73.0%	69.2%	78.7%	71.9%	66.2%	70.2%	62.2%	70.6%
	Often or always	22.3%	30.7%	27.0%	<b>30.8%</b>	21.3%	28.1%	<b>33.8%</b>	29.8%	<b>37.8%</b>	29.4%
	N	3880	7524	1180	1177	681	3489	668	3516	2873	24988
Worry about making mistakes	seldom or sometimes	84.6%	73.7%	73.4%	59.3%	81.7%	71.2%	66.0%	75.6%	64.9%	73.7%
	Often or always	15.4%	26.3%	26.6%	<b>40.7%</b>	18.3%	28.8%	<b>34.0%</b>	24.4%	<b>35.1%</b>	26.3%
	N	4018	7761	1212	1188	688	3563	694	3564	2848	25536
Overcommitment score	Low	76.6%	68.6%	66.6%	68.9%	84.1%	71.7%	70.0%	73.1%	70.0%	71.6%
	High	23.4%	<b>31.4%</b>	<b>33.4%</b>	<b>31.1%</b>	15.9%	28.3%	30.0%	26.9%	30.0%	28.4%
	N	3848	7388	685	939	685	3475	487	3115	2699	23321
Have many interruptions and disturbances in the job	No or not disturbing	65.8%	29.9%	33.0%	32.7%	51.2%	31.0%	29.9%	24.3%	28.2%	35.9%
	yes moderat. disturb.	24.5%	41.6%	41.0%	31.7%	35.2%	38.2%	44.3%	42.3%	34.9%	37.0%
	yes considerab. dist.	9.7%	28.5%	26.0%	<b>35.6%</b>	13.6%	<b>30.8%</b>	25.8%	<b>33.4%</b>	<b>36.9%</b>	27.1%
Quality of teamwork	N	3869	7465	693	947	685	3522	488	3150	2713	23532
	High	61.4%	37.4%	41.1%	30.7%	47.4%	31.7%	35.2%	36.1%	27.8%	39.4%
	Medium	32.2%	48.4%	44.8%	49.9%	43.1%	47.5%	49.5%	50.0%	50.7%	45.9%
Quantitative demand	Low	6.4%	14.2%	14.2%	<b>19.3%</b>	9.5%	<b>20.8%</b>	<b>15.3%</b>	13.9%	<b>21.5%</b>	14.8%
	N	3670	6934	650	859	663	3275	463	2988	2525	22027
	Low	14.4%	12.1%	10.4%	6.8%	13.6%	11.7%	11.6%	7.3%	6.2%	10.8%
Physical load score	Medium	56.1%	50.0%	48.6%	48.9%	58.0%	51.6%	50.6%	47.6%	42.9%	50.2%
	High	29.5%	37.9%	<b>41.0%</b>	<b>44.3%</b>	28.4%	36.8%	37.7%	<b>45.0%</b>	<b>50.9%</b>	39.1%
	N	4029	7793	1215	1203	691	3575	697	3573	2890	25666
Satisfied w. working T / well being	Low	61.4%	37.4%	41.1%	30.7%	47.4%	31.7%	35.2%	36.1%	27.8%	39.4%
	Medium	32.2%	48.4%	44.8%	49.9%	43.1%	47.5%	49.5%	50.0%	50.7%	45.9%
	High	6.4%	14.2%	14.2%	<b>19.3%</b>	9.5%	<b>20.8%</b>	15.3%	13.9%	<b>21.5%</b>	14.8%
How often do you feel tired?	N	3686	6820	1130	1066	654	3287	616	3425	2654	23338
	Yes	84.3%	72.5%	74.0%	67.4%	77.7%	64.9%	71.3%	61.9%	60.6%	70.4%
	No	15.7%	27.5%	26.0%	<b>32.6%</b>	22.3%	<b>35.1%</b>	28.7%	<b>38.1%</b>	<b>39.4%</b>	29.6%
Burnout	N	3960	7613	1196	1201	686	3483	680	3542	2879	25240
	seldom	64.8%	51.7%	46.8%	50.9%	69.0%	55.6%	49.0%	49.6%	51.8%	54.1%
	3 / week +	35.2%	48.3%	<b>53.2%</b>	<b>49.1%</b>	31.0%	44.4%	<b>51.0%</b>	<b>50.4%</b>	<b>48.2%</b>	45.9%
Work ability index	N	4005	7790	1217	1204	687	3548	690	3564	2886	25591
	Low	83.6%	67.7%	67.6%	67.4%	90.0%	73.4%	66.3%	71.7%	67.6%	72.1%
	High	16.4%	<b>32.3%</b>	<b>32.4%</b>	<b>32.6%</b>	10.0%	26.6%	<b>33.7%</b>	28.3%	<b>32.4%</b>	27.9%
In periods of work, quality of your sleep?	N	3980	7738	1217	1185	688	3519	685	3545	2862	25419
	High	81.6%	70.3%	72.9%	64.7%	86.0%	74.9%	70.1%	74.0%	65.2%	72.9%
	Low	18.4%	29.7%	27.1%	<b>35.3%</b>	14.0%	25.1%	<b>29.9%</b>	26.0%	<b>34.8%</b>	27.1%
In periods of work, do you get sufficient sleep?	N	3664	6873	1109	1118	634	2930	613	3368	2714	23023
	Bad .rather bad	10.9%	18.4%	<b>19.3%</b>	<b>17.6%</b>	13.0%	19.5%	<b>21.6%</b>	<b>19.4%</b>	<b>21.6%</b>	17.7%
	Moderate	33.5%	39.9%	38.8%	<b>44.1%</b>	31.9%	43.1%	<b>42.9%</b>	<b>40.3%</b>	<b>45.1%</b>	39.9%
Sick leave	Rather good	55.6%	41.7%	41.9%	38.2%	55.2%	37.4%	35.5%	40.3%	33.3%	42.3%
	N	3879	7456	688	947	687	3509	485	3129	2697	23477
	Not .quite enough	35.1%	49.0%	47.8%	<b>50.7%</b>	37.5%	<b>51.5%</b>	<b>55.9%</b>	<b>54.5%</b>	<b>59.8%</b>	48.9%
Sick leave	Yes. almost yes	64.9%	51.0%	52.2%	49.3%	62.5%	48.5%	44.1%	45.5%	40.2%	51.1%
	N	3877	7449	688	940	685	3500	487	3124	2680	23430
	No sick-leave	44.4%	47.2%	39.9%	<b>57.2%</b>	34.7%	44.4%	<b>49.5%</b>	40.8%	<b>58.0%</b>	46.5%
Sick leave	1-5	28.0%	23.6%	32.7%	<b>17.9%</b>	<b>39.5%</b>	<b>26.2%</b>	<b>25.2%</b>	<b>31.1%</b>	<b>14.5%</b>	25.4%
	>5	27.6%	<b>29.2%</b>	27.3%	24.9%	25.8%	<b>29.4%</b>	25.2%	<b>28.1%</b>	27.6%	28.1%
	N	3854	7214	1179	1076	659	3342	646	3456	2678	24104

One-third of Nurses working 12-hour shifts during the day, 10- hour shifts at night and alternating shifts are dissatisfied with their working time relative to their well being. Nurses working 10- or 12-hour shifts during the day, 12-hour shifts at night and alternating shifts feel more often tired, and have more frequently a high burnout score. For nurses working 12-hour shifts during the day and alternating shifts  $\geq 6$  nights, Work ability index is more frequently low. In periods of work, their quality and quantity of sleep is more frequently bad. Nurses working 12-hour shifts during the day and alternating shifts  $\geq 6$  nights take short sick leaves less often, since they work less

often, but require an equal number of long sick leaves.

### 3.3. Multivariate analysis of determinants for family and personal satisfaction

Among work schedules, it is 8- and 10-hour shifts at night and alternating morning and afternoon shifts  $< 6$  nights that are the greatest risk factors for dissatisfaction with working time, with respect to private life and well-being (Table 3). But, not having enough childcare when at work is more important than the work schedule and work content has the most importance.

Table 3

Multivariate analysis of Work schedules and other risk factors for work /Family conflicts and dissatisfaction with working time for private life and wellbeing, among European nurses

		Work / family conflicts				Dissatisfied w. working time / Private life				Dissatisfied w. working time / Wellbeing			
		N	adjOR*	p	95% CI	N	adjOR*	p	95% CI	N	adj OR*	p	95% CI
Work schedule	Part time	2415	1.00			2410	1.00			2650	1.00		
	Day 8 h	3705	1.07	ns	0.92 1.25	3671	<b>1.28</b>	***	1.11 1.49	4281	<b>1.13</b>	ns	0.97 1.32
	Day 10 h	353	1.10	ns	0.84 1.44	346	1.23	ns	0.94 1.60	429	1.09	ns	0.82 1.44
	Day 12h	619	0.86	ns	0.67 1.09	613	0.87	ns	0.68 1.11	677	1.17	ns	0.90 1.51
	Night 8 h	551	<b>1.22</b>	ns	0.98 1.52	548	<b>1.36</b>	**	1.09 1.69	570	<b>1.27</b>	*	1.01 1.60
	Night 10h	2222	<b>1.16</b>	ns	0.99 1.35	2186	<b>1.39</b>	***	1.19 1.62	2447	<b>1.19</b>	*	1.02 1.39
	Night 12h	265	0.89	ns	0.66 1.21	264	0.97	ns	0.72 1.30	317	1.24	ns	0.92 1.67
	Alter $< 6N/m$	1873	1.03	ns	0.88 1.22	1874	<b>1.43</b>	***	1.22 1.68	2125	<b>1.22</b>	*	1.03 1.45
Enough child care when at work	Alter $\geq 6N/m$	1947	0.97	ns	0.80 1.16	1927	1.16	ns	0.97 1.38	2074	1.00	ns	0.83 1.20
	Yes or no answer	12400	1.00			12317	1.00			13859	1.00		
	No	1550	<b>1.94</b>	***	1.69 2.24	1522	<b>1.63</b>	***	1.45 1.84	1711	<b>1.36</b>	***	1.20 1.54
	Quality of teamwork score	5186	1.00			5145	1.00			5814	1.00		
	High	6531	<b>1.61</b>	***	1.47 1.76	6480	<b>1.54</b>	***	1.41 1.69	7292	<b>2.04</b>	***	1.84 2.26
	Medium	2233	<b>2.13</b>	***	1.84 2.47	2214	<b>2.27</b>	***	1.99 2.59	2464	<b>4.18</b>	***	3.65 4.79
	Low	10172	1.00			10097	1.00			11309	1.00		
	High	3778	<b>2.45</b>	***	2.21 2.71	3742	<b>1.63</b>	***	1.49 1.79	4261	<b>1.30</b>	***	1.18 1.42
Many interruptions and disturbances in the job	No or not disturb.	4991	1.00			4959	1.00			5529	1.00		
	Moderately disturb.	5115	<b>1.66</b>	***	1.51 1.82	5065	<b>1.41</b>	***	1.28 1.55	5767	1.03	ns	0.93 1.14
	Considerably disturbing	3844	<b>2.17</b>	***	1.92 2.45	3815	<b>1.64</b>	***	1.46 1.84	4274	<b>1.34</b>	***	1.19 1.50
Quantitative demand score	Low	1510	1.00			1500	1.00						
	Medium	6928	<b>1.30</b>	***	1.14 1.48	6882	1.28	***	1.11 1.48				
	High	5512	<b>1.58</b>	***	1.36 1.83	5457	<b>1.50</b>	***	1.28 1.75				
Get up before 5 o'clock	No	9943	1.00			9876	1.00			11201	1.00		
	1-5/ month	3028	1.29	***	1.16 1.43	2988	1.28	***	1.16 1.41	3270	<b>1.15</b>	**	1.04 1.28
	6+/ month	979	<b>1.48</b>	***	1.25 1.75	975	<b>1.54</b>	***	1.33 1.80	1099	<b>1.12</b>	ns	0.96 1.31
Take over shifts at short notice	$< 2$ / month	12525	1.00			12435	1.00			14008	1.00		
	$> 2$ / month	1425	<b>1.42</b>	***	1.23 1.64	1404	<b>1.47</b>	***	1.29 1.66	1562	<b>1.15</b>	*	1.02 1.31
Weekend work	$< 2$ / month	9867	1.00			9802	1.00						
	$> 2$ / month	4083	<b>1.28</b>	***	1.15 1.43	4037	<b>1.58</b>	***	1.42 1.75				
Split shifts	No	10208	1.00			10146	1.00						
	Yes	3742	<b>1.14</b>	**	1.04 1.25	3693	<b>1.27</b>	***	1.16 1.39				
Satisfied with staff handovers	Yes	8052	1.00			7978	1.00			9011	1.00		
	No	5898	<b>1.17</b>	***	1.07 1.27	5861	<b>1.29</b>	***	1.19 1.40	6559	<b>1.10</b>	*	1.01 1.20
Physical load score	Low	3492	1.00			3466	1.00			4019	1.00		
	Medium	5180	1.05	ns	0.95 1.17	5134	<b>1.15</b>	**	1.03 1.27	5697	1.09	ns	0.98 1.22
	High	5278	<b>1.17</b>	**	1.05 1.31	5239	<b>1.14</b>	*	1.02 1.27	5854	<b>1.16</b>	**	1.04 1.30
Gender	Male	1865	1.00			1839	1.00			2040	1.00		
	Female	12085	<b>1.31</b>	***	1.16 1.48	12000	<b>1.12</b>	*	1.00 1.25	13530	<b>0.86</b>	**	0.77 0.96

\*Adjusted Odds ratios: adjusted also in the model on Country, Age, Seniority, Department of work, Occupational level, Family situation, Satisfaction with pay., ns= not significant; \*= $p < .05$ ; \*\*= $p < .01$ ; \*\*\*= $p < .001$

Nurses reporting a low quality of teamwork have twice as many conflicts and dissatisfaction. Nurses with a high score of over-commitment see their personal life deteriorate. Interruptions at work and quantitative job demands are also more important to explain W/FC and dissatisfaction with respect to private life and well-being. Other aspects of work schedule have to be taken into consideration: Get up before 5 o'clock Take over shifts at short notice; Weekend work; Split shifts; Satisfaction with staff handovers.

### 3.4. Multivariate analysis of determinants for health and safety

Among work schedules, extended work shifts is the greatest risk factor for burnout, low WAI and frequent worries about making mistakes (Table 4).

Work content is again of major importance. Nurses reporting a low quality of teamwork have three times as much burnout, low WAI and two thirds more worries about making mistakes. Nurses with a high score of over-commitment are nearly twice as exhausted and worry more about making mistakes. Interruptions at work and quantitative demands are also more important to explain burnout, low WAI and worries about making mistakes.

Table 4  
Multivariate analysis of Work schedules and other risk factors for health and safety, among European nurses

		Burnout				Work ability index				Frequent Worries about making Mistakes			
		N	adj OR*	p	95% CI	N	adj OR*	p	95% CI	N	adj OR*	p	95% CI
Work schedule	Part time	3028	1.00			2634	1.00			3483	1.00		
	Day 8 h	4581	1.14	ns	0.97 1.33	3723	0.96	ns	0.82 1.13	5993	1.00	ns	0.87 1.15
	Day 10 h	446	1.21	ns	0.93 1.57	372	0.91	ns	0.69 1.21	539	1.15	ns	0.90 1.46
	Day 12h	669	1.06	ns	0.83 1.35	624	0.89	ns	0.70 1.15	771	1.15	ns	0.93 1.42
	Night 8 h	587	0.92	ns	0.65 1.31	545	1.07	ns	0.80 1.43	646	1.16	ns	0.90 1.49
	Night 10h	2622	<b>1.22</b>	*	1.03 1.46	2139	<b>1.13</b>	ns	0.94 1.34	3038	1.00	ns	0.86 1.16
	Night 12h	326	<b>1.34</b>	*	1.00 1.78	273	<b>1.11</b>	ns	0.81 1.51	412	<b>1.45</b>	**	1.13 1.87
	Alter. <6nights/m	1944	1.07	ns	0.90 1.29	1849	0.94	ns	0.78 1.13	2431	1.13	ns	0.96 1.32
	Alter. ≥6nN/m.	2061	1.10	ns	0.91 1.33	1938	0.92	ns	0.76 1.12	2304	1.05	ns	0.89 1.24
Enough child care when at work	Yes or no answer	14467	1.00			12586	1.00						
	No	1797	<b>1.37</b>	***	1.22 1.55	1511	<b>1.28</b>	***	1.13 1.45				
Quality of teamwork score	High	6183	1.00			5397	1.00			7644	1.00		
	Medium	7539	<b>1.93</b>	***	1.74 2.14	6548	<b>1.78</b>	***	1.60 1.98	9019	<b>1.25</b>	***	1.15 1.37
	Low	2542	<b>3.27</b>	***	2.86 3.75	2152	<b>3.23</b>	***	2.80 3.74	2954	<b>1.67</b>	***	1.49 1.87
Overcommitment score	Low	11739	1.00			10239	1.00			14103	1.00		
	High	4525	<b>2.98</b>	0.000	2.73 3.24	3858	<b>1.97</b>	***	1.79 2.16	5514	<b>1.88</b>	***	1.74 2.03
Many interruptions and disturbances in the job	No or not disturb.	5913	1.00	***		5169	1.00			7138	1.00		
	Moderately dist.ur	5948	1.27	***	1.14 1.41	5137	1.12	*	1.00 1.26	7189	1.19	***	1.09 1.31
	Considerably dist.	4403	<b>2.06</b>	***	1.83 2.32	3791	<b>1.49</b>	***	1.31 1.69	5290	<b>1.70</b>	***	1.54 1.89
Quantitative demand score	Low	1796	1.00			1530	1.00			2170	1.00		
	Medium	8150	1.10	ns	0.93 1.30	7040	1.17	ns	0.99 1.39	9889	<b>1.31</b>	***	1.14 1.51
	High	6318	<b>1.31</b>	**	1.10 1.56	5527	<b>1.34</b>	***	1.12 1.61	7558	<b>1.68</b>	***	1.45 1.94
get up before 5 o'clock	No	11903	1.00										
	1-5/month	3276	1.03	ns	0.93 1.14								
	6+/month	1085	<b>1.39</b>	***	1.19 1.61								
Satisfied with staff handovers	Yes					8274	1.00						
	No					5823	<b>1.18</b>	***	1.08 1.30				
Physical load score	Low	4663	1.00	0.000		3805	1.00						
	Medium	5840	1.10	ns	0.98 1.23	5148	1.11	ns	0.98 1.25				
	High	5761	<b>1.26</b>	***	1.12 1.42	5144	<b>1.39</b>	***	1.23 1.57				
Gender	Male	2131	1.00			1837	1.00						
	Female	14133	<b>1.82</b>	***	1.59 2.07	12260	<b>1.36</b>	***	1.19 1.57				

\*Adjusted Odds ratios: adjusted also on Country, Age, Seniority, Department of work, Occupational level, Family situation, Satisfaction with pay, Weekend work; Split shifts.  
ns= not significant; \*= $p < .05$ ; \*\*= $p < .01$ ; \*\*\*= $p < .001$

### 3.5. Multivariate analysis of determinants for stability in the job

Among work schedules, 8- and 10-hour shifts at night and alternating shifts <6 nights are the greatest

risk factor for Intent to change work setting (ITC); (Table 5). Work schedules have no significant influence for Sick leave >5days and Intent to leave nursing (ITL).

In this analysis also work content has the greatest influence. Nurses reporting a low quality of teamwork have four times as much ITC and seven times as much ITL. This is also the highest risk factor for sick leave. A high score of Over-commitment and frequent Interruptions at work are also more

important to explain ITC and ITL. High quantitative demand, physical load, Take over shifts at short notice, Weekend work, Split shifts, and dissatisfaction with staff handovers contribute also significantly to Sick leave.

Table 5  
Multivariate analysis of Work schedules and other risk factors for determinants for stability in the job, among European nurses

		Sick leave >5days				Intent to change work setting (ITC)				Intent to leave nursing (ITL)			
		N	adj OR*	p	95% CI	N	adj OR*	p	95% CI	N	adj OR*	p	95% CI
Work schedule	Part time	2373	<b>1.38</b>	***	1.18 1.61	2650	1.00			3041	1.00		
	Day 8 h	3717	1.12	ns	0.98 1.29	4281	1.13	ns	0.97 1.32	4942	0.97	ns	0.81 1.16
	Day 10 h	384	1.16	ns	0.89 1.51	429	1.09	ns	0.82 1.44	447	1.19	ns	0.87 1.62
	Day 12h	545	1.12	ns	0.87 1.44	677	1.17	ns	0.90 1.51	710	0.92	ns	0.68 1.25
	Night 8 h	531	1.00	ns	0.80 1.26	570	<b>1.27</b>	*	1.01 1.60	582	1.23	ns	0.92 1.65
	Night 10h	2170	<b>1.00</b>			2447	<b>1.19</b>	*	1.02 1.39	2712	0.90	ns	0.75 1.09
	Night 12h	257	1.05	ns	0.77 1.44	317	1.24	ns	0.92 1.67	356	1.31	ns	0.95 1.82
	Alte. <6nights/m	2136	0.99	ns	0.85 1.17	2125	<b>1.22</b>	*	1.03 1.45	1918	1.05	ns	0.85 1.29
	Alter. ≥6nN/m.	1880	<b>1.19</b>	*	1.00 1.41	2074	1.00	ns	0.83 1.20	2097	0.96	ns	0.77 1.20
Enough child care when at work	Yes or no answer					13859	1.00			14934	1.00		
	No					1711	<b>1.36</b>	***	1.20 1.54	1871	<b>1.28</b>	***	1.11 1.46
Quality of teamwork score	High	5288	1.00			5814	1.00			6392	1.00		
	Medium	6561	<b>1.11</b>	*	1.01 1.22	7292	<b>2.04</b>	***	1.84 2.26	7758	<b>2.81</b>	***	2.45 3.23
	Low	2144	<b>1.38</b>	***	1.20 1.58	2464	<b>4.18</b>	***	3.65 4.79	2655	<b>7.23</b>	***	6.16 8.48
Overcommitment score	Low					11309	1.00			12074	1.00		
	High					4261	<b>1.30</b>	***	1.18 1.42	4731	<b>1.46</b>	***	1.32 1.62
Many interruptions and disturbances in the job	No or not disturb.					5529	1.00			6121	1.00		
	Moderately dist.ur					5767	1.03	ns	0.93 1.14	6143	0.99	ns	0.87 1.13
	Considerably dist.					4274	<b>1.34</b>	***	1.19 1.50	4541	<b>1.28</b>	***	1.11 1.46
Quantitative demand score	Low	1457	1.00										
	Medium	6986	<b>1.17</b>	*	1.02 1.35								
	High	5550	<b>1.19</b>	*	1.02 1.39								
get up before 5 o'clock	No					11201	1.00						
	1-5/month					3270	<b>1.15</b>	**	1.04 1.28				
	6+/month					1099	<b>1.12</b>	ns	0.96 1.31				
Take over shifts at short notice	<+2/m	12595	1.00			14008	1.00						
	> 2 / m	1398	<b>1.22</b>	***	1.08 1.38	1562	<b>1.15</b>	*	1.02 1.31				
Weekend work	<+2/m	9766	1.00										
	> 2 / m	4227	<b>1.13</b>	*	1.02 1.26								
Split shifts	No	10370	1.00										
	Yes	3623	<b>1.14</b>	**	1.04 1.24								
Satisfied with staff handovers	Yes	8151	1.00			9011	1.00						
	No	5842	<b>1.19</b>	***	1.09 1.29	6559	<b>1.10</b>	*	1.01 1.20				
Physical load score	Low	3558	1.00			4019	1.00						
	Medium	5201	1.02	ns	0.92 1.14	5697	1.09	ns	0.98 1.22				
	High	5234	<b>1.16</b>	**	1.04 1.30	5854	<b>1.16</b>	**	1.04 1.30				
Gender	Male	1849	1.00			2040	1.00						
	Female	12144	<b>1.13</b>	*	1.00 1.27	13530	<b>0.86</b>	**	0.77 0.96				

\*Adjusted Odds ratios: adjusted also in the model on Country, Age, Seniority, Department of work, Occupational level, Family situation, Satisfaction with pay.  
ns= not significant; \*=p<.05; \*\*=p<.01; \*\*\*=p<.001

#### 4. Discussion

From our multivariate analysis, which included twenty explanatory variables simultaneously, we found that work schedule itself is not a major determinant factor for the different aspects analysed.

Indeed, having to take over shifts at short notice, having to get up before five o'clock in the morning to go to work, or not having enough child care when at work, appear to be stronger risk factors than work schedule itself for Work family conflicts, Satisfaction, Health and Safety problems.



Nightly 8- and 10-hour shifts and alternating shifts with <6 nights per month appeared to be detrimental to nurses' satisfaction with work duration and shift, for their private life, well-being and increase their intent to change work setting. Nightly 10- and 12-hour shifts appeared to be linked with more burnout and low Work ability index. Nightly 12-hour shifts increase by nearly 50% worries about making mistakes. Alternating shifts with  $\geq 6$  nights per month appear to be linked with an increase in sick leave of more than 5 days.

The multivariate analysis demonstrated that inadequate work content and social support (low quality of teamwork, dissatisfaction with staff handovers, having many interruptions and disturbances in the job and over-commitment are the highest risk factors for health effects. They have much more influence in comparison to the impact of work schedules, for association with work/family conflicts as well as health problems.

We conclude that nurses tend to choose or accept these night shifts or 12-hour shifts in order to reduce their work/home conflicts (working only 3 shifts of 12 hours per week), however, at the expense of their health. These work schedules appear to be more often linked to burnout. Moreover, there are legitimate concerns about the safety of the employee and the patient in an extended work hour environment.

Indeed a recent very broad review by Wagstaff and Sigstad. (2011) concluded that work periods >8 hours carry an increased risk of accidents that cumulates, so that the increased risk of accidents after about 12 hours is twice the risk after 8 hours. Their analysis demonstrated also that shift work including nights carries a substantial risk of accidents. More specifically, Olds and Clarke (2010) demonstrated that, even in the case of voluntary overtime, each additional three hour period worked per week, past 40 hours, was associated with an average increase of 3% of reported wrong medication or dose administration errors and of 3% of needlestick injuries.

Although the implementation of 12-hour shifts seemed to be an answer to work/family conflicts for nurses, and, as such, responded to the recruitment problems for managers, the risk for health and quality of care has been highly underestimated. Therefore, it is important to develop measures, such as extended child care, association of nurses for the elaboration of their rota, 9- or 10-hour shifts in the afternoon, allowing naps during night shifts, and reduction of changing shifts at short notice and to study its effects.

Work schedules must be organized in order to allow time for shift handover, social support and team building.

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